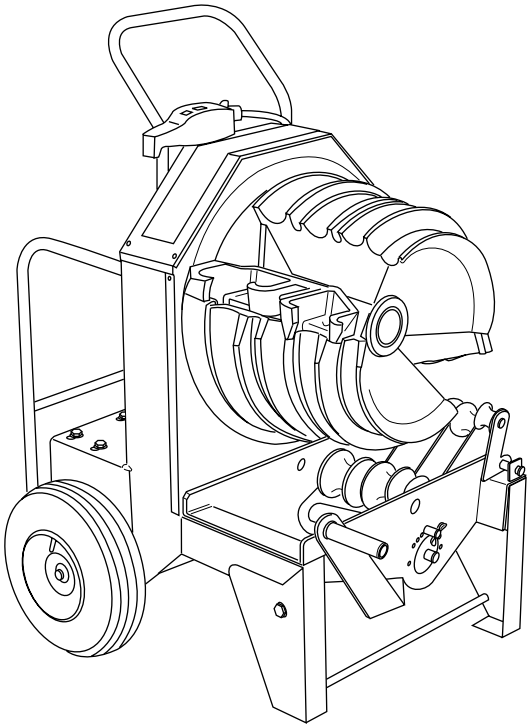
INSTRUCTION MANUAL

GREENLEE®



853

QUAD BENDER™

Read and **understand** all of the instructions and safety information in this manual before operating or servicing this tool.

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Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tool provide information for avoiding hazards and unsafe practices related to the use of this tool. Observe all of the safety information provided.

Purpose

This manual is intended to familiarize personnel with the safe operation and maintenance procedures for the Greenlee 853 Quad Bender™, Serial Code ADW.

Keep this manual available to all personnel.

Replacement manuals are available upon request at no charge.

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Description

The Greenlee 853 Quad Bender™ is intended to bend 1" to 2" EMT, IMC, rigid steel, and rigid aluminum conduit from 0 through 90 degrees.

The Greenlee 853 Quad Bender™ is protected by U.S. patent No. 5,226,305.

Other Publications

Service Manual:

SB 285: Publication 999 3877.4

KEEP THIS MANUAL

IMPORTANT SAFETY INFORMATION

SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

⚠DANGER

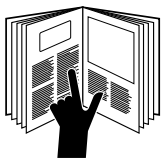
Immediate hazards which, if not avoided, WILL result in severe injury or death.

⚠WARNING

Hazards which, if not avoided, COULD result in severe injury or death.

⚠CAUTION

Hazards or unsafe practices which, if not avoided, MAY result in injury or property damage.



⚠DANGER

Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

Failure to observe this warning will result in severe injury or death.

⚠DANGER

Do not use this tool in a hazardous environment. Hazards include flammable liquids, gases, or other materials. Using this tool in a hazardous environment can result in a fire or explosion.

Failure to observe this warning will result in severe injury or death.

⚠WARNING

Electric shock hazard:

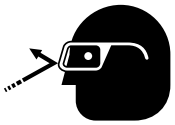
- Connect the power cord to a 120 volt, 20 amp receptacle on a ground fault protected circuit only. See Grounding Instructions.
- Do not modify the power cord or plug.
- Inspect the power cord before use. Repair or replace the cord if damaged.
- Disconnect from power before servicing.

Failure to observe this warning can result in severe injury or death.

⚠WARNING

- Do not expose to rain.
- Do not use in wet or damp locations.

Failure to observe these warnings can result in severe injury or death.



⚠WARNING

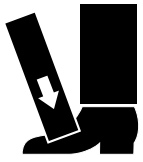
Wear eye protection when operating or servicing this tool.

Failure to wear eye protection can result in serious eye injury from flying debris.

⚠WARNING

Do not remove guards.

Failure to observe this warning can result in severe injury or death.



⚠WARNING

Wear protective footwear when operating or servicing this tool.

Failure to observe this warning can result in severe injury.

IMPORTANT SAFETY INFORMATION

⚠WARNING

Extension cords:

- Use only three-wire, 12-gauge extension cords that have three-prong grounding-type plugs and three-hole receptacles that accept the tool's plug.
- Do not use extension cords that are longer than 30 m (100').
- Repair or replace damaged extension cords.

Failure to observe these warnings can result in severe injury or death.

⚠WARNING

Make sure that the handle is properly installed and secured with the safety spring clips and snap pins before lifting or moving the bender. An improperly installed handle could allow the bender to fall, injuring nearby personnel.

Failure to observe this warning can result in severe injury or death.

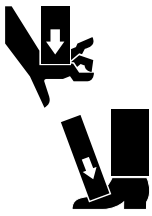
⚠WARNING

Pinch points:

Keep hands away from bending shoe, rollers and conduit when bender is in use.

⚠WARNING

Unplug the bender before changing accessories. Accidental start-up can result in serious injury.



⚠WARNING

Bending shoe weighs 42 kg (92 lbs) and may require more than one person to lift and assemble.

Failure to observe this warning can result in severe injury.

⚠CAUTION

Do not use as a step or ladder.

⚠CAUTION

- Conduit moves rapidly as it is bent. The path of the conduit must be clear of obstructions. Be sure clearance is adequate before starting the bend.
- Do not operate the bender while wearing loose clothing. Loose clothing can get caught in moving parts.
- Inspect the bender before use. Replace worn, damaged or missing parts with Greenlee replacement parts. A damaged or improperly assembled component could break and strike nearby personnel.
- Some bender parts and accessories are heavy and may require more than one person to lift and assemble.
- Use this tool for the manufacturer's intended purpose only. Use other than that which is instructed in this manual can result in injury or property damage.

Failure to observe these precautions can result in injury or property damage.

Grounding Instructions

⚠WARNING

Electric shock hazard:

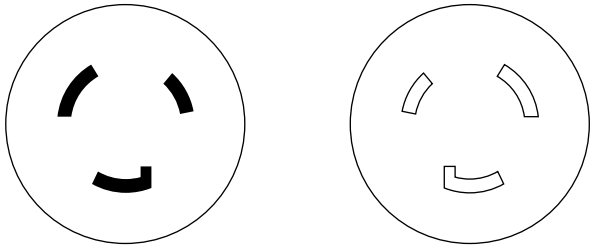
- Do not modify the plug provided with the tool.
- Connect this tool to a grounded receptacle on a 20 amp ground fault protected circuit.

Failure to observe these warning can result in severe injury or death.

This tool must be grounded. In the event of a malfunction or breakdown, an electrical ground provides a path of least resistance for the electric current. This path of least resistance is intended to reduce the risk of electric shock.

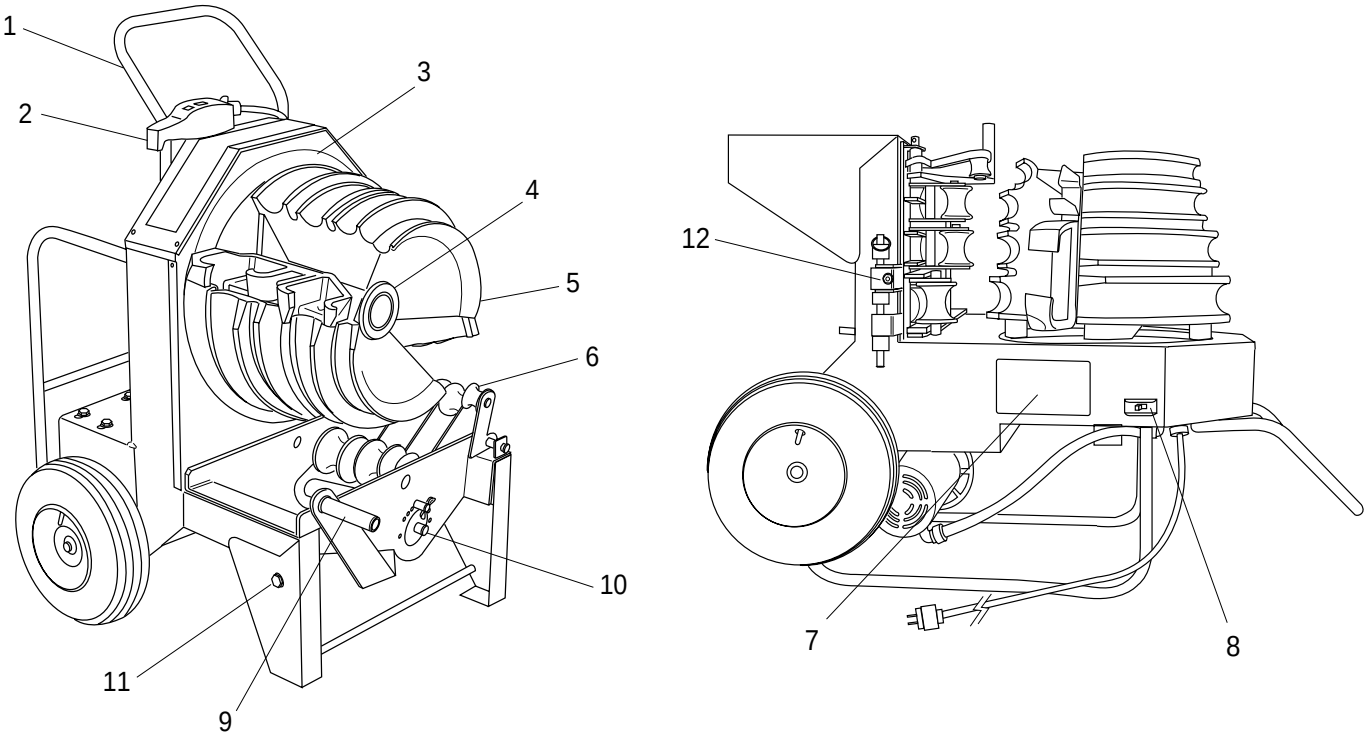
This tool's electric cord has a grounding conductor and a grounding plug as shown. Do not modify the plug. Connect the plug to a corresponding GFCI-protected receptacle that is properly installed and grounded in accordance with all national and local codes and ordinances.

Do not use an adapter.



Plug **Receptacle**

Identification



853 Quad Bender™

1. Handle
2. Pendant
3. Protractor
4. Main Shaft
5. Bending Shoe
6. 1" to 2" Roller Support
7. Bending Instructions Decal
8. Circuit Breaker (ON/OFF switch)
9. Support Roller Engagement Handle/Pedal
10. Support Roller Squeeze Adjustment
11. L.H. Locator for Roller Support Assembly
12. R.H. Locator for Roller Support Assembly

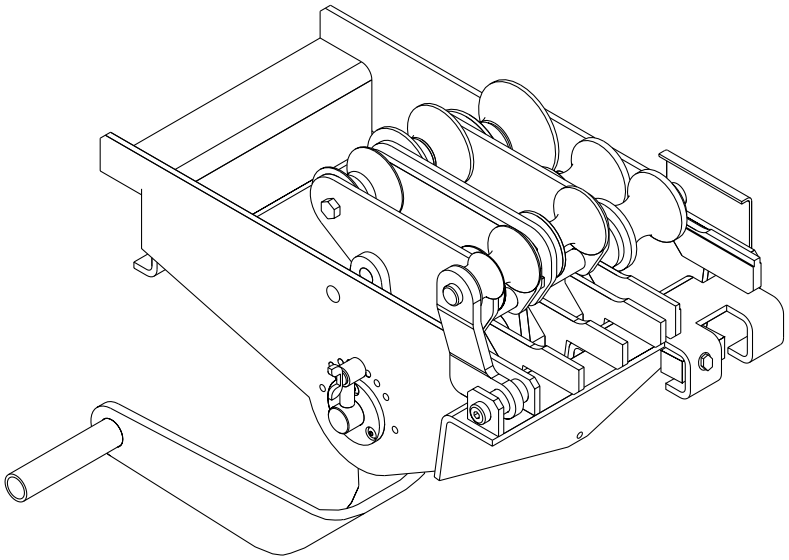
Specifications

Height ..... 1118 mm (44")
Width ..... 775 mm (30.5")
Depth ..... 889 mm (35")
Mass/Weight ..... 202 Kg (445 lb)
Power Supply ..... 120 VAC, 20 amp GFCI-protected receptacle
Operating Conditions
- Temperature ..... –20 °C to 49 °C (–5 °F to 120 °F)
- Relative Humidity ..... 0 to 98%

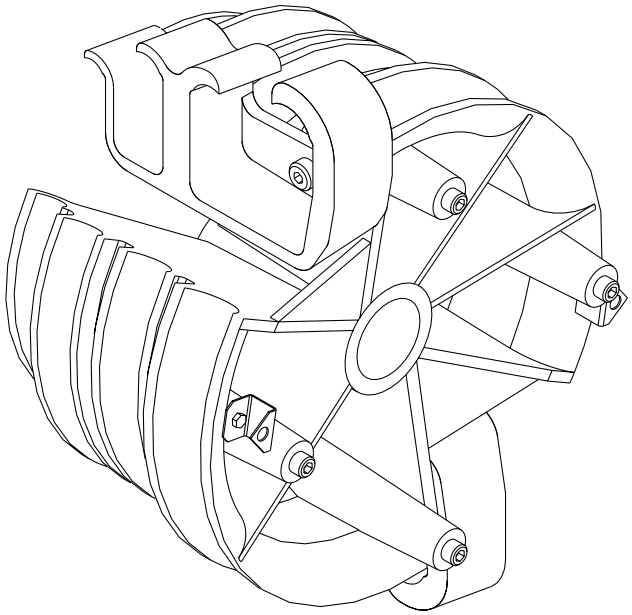
Capacity ..... 1" to 2" EMT, IMC and Rigid Steel and Rigid Aluminum Conduit

Identification (cont'd)

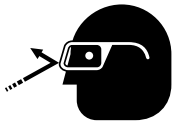
Roller Support Assembly (500 7267.6)



Bending Shoe (500 7271.4)



Setup



⚠WARNING

Wear eye protection when operating or servicing this tool.

Failure to wear eye protection can result in serious eye injury from flying debris.

⚠WARNING

Unplug the bender before changing accessories. Accidental start-up can result in serious injury.

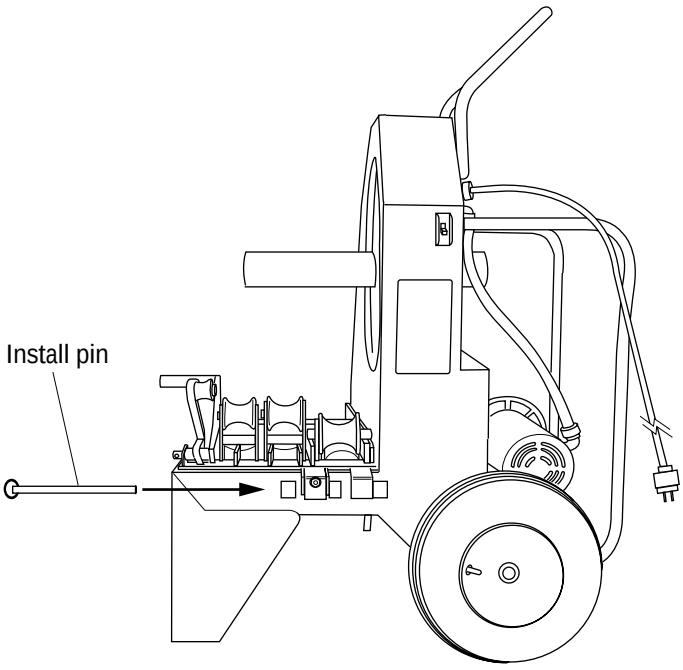
⚠CAUTION

Some bender parts and accessories are heavy and may require more than one person to lift and assemble.

Failure to observe these precautions can result in injury or property damage.

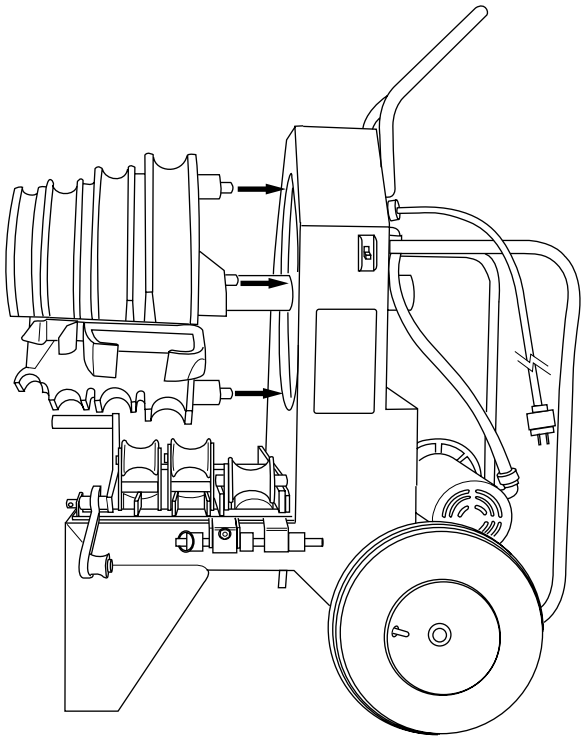
1. Mount the support unit onto the leg of the bender. Install left side of Roller Support Assembly on left leg of bender first then lower right side of Roller Support Assembly onto right leg. Install the hinge pin, as shown.

Roller Support Assembly Installed



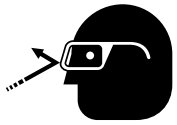
2. Slide the bending shoe onto the shaft of the main sprocket, as shown. Align the four drive studs on the back of the shoe with the four holes in the main sprocket.

Installing a Bending Shoe



3. Place the bender in either the vertical or horizontal bending position.

Operation



⚠WARNING

Wear eye protection when operating or servicing this tool.

Failure to wear eye protection can result in serious eye injury from flying debris.

⚠WARNING

Pinch points:

Keep hands away from bending shoe, rollers and conduit when bender is in use.

⚠WARNING

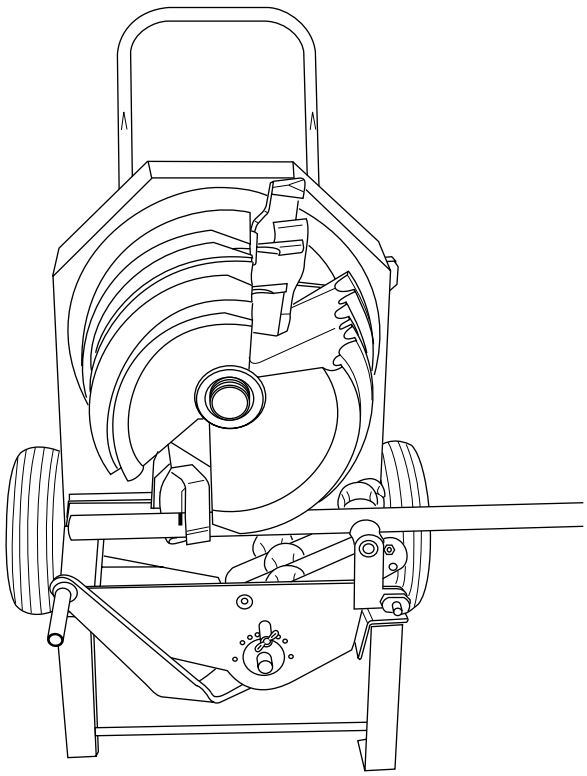
Do not operate the bender while wearing loose clothing. Loose clothing can get caught in moving parts.

Failure to observe this warning can result in severe injury or death.

BENDING CONDUIT

1. Plug the cord into an appropriate receptacle. See Grounding Instructions.
2. Turn the circuit breaker (ON/OFF switch) to ON.
3. Press BEND or UNLOAD until the shoe is 5° to 10° before the 0° starting point.
4. Load the conduit so that the bending mark is aligned with the front edge of the shoe hook.

Loading the Conduit



5. Refer to the instruction decal for the appropriate bend angle.

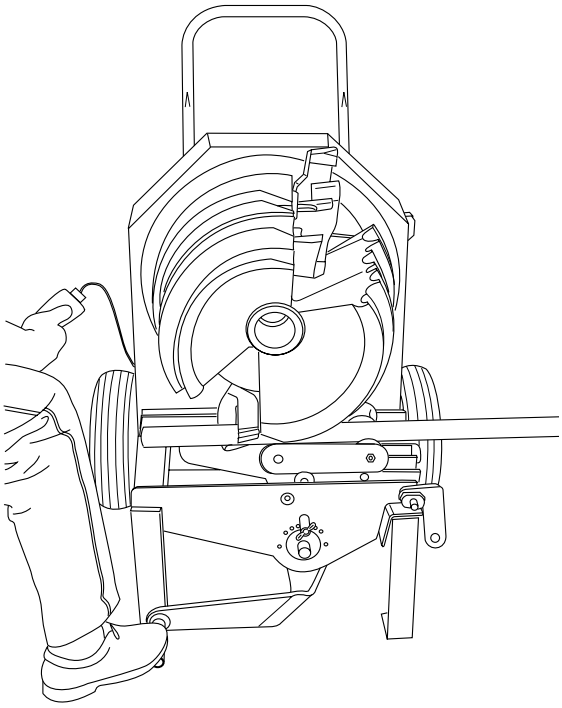
Operation (cont'd)

6. Bend the conduit:

1-1/4" to 2" EMT, IMC and Aluminum Rigid Conduit:

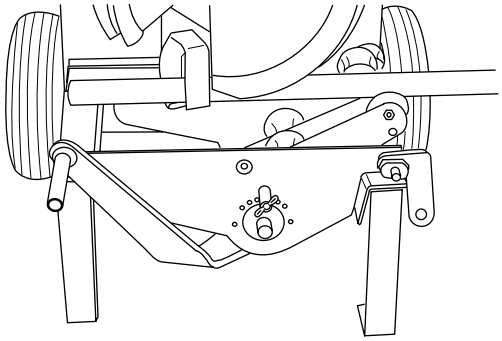
Note: For aluminum rigid conduit, decrease the squeeze by three settings.

Engaging the Loading Pedal
(for 1-1/4" to 2" EMT, IMC and Aluminum Rigid Conduit only)



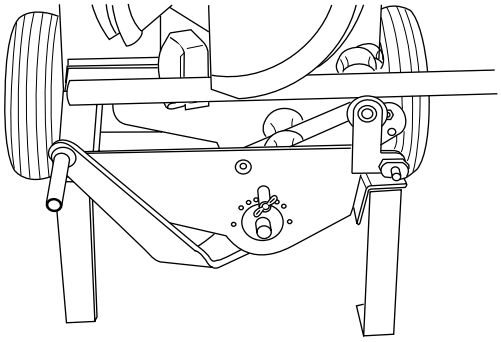
a. Place one foot on the loading pedal, as shown.
b. Press and hold BEND. The bender will pull up the roller support. When the roller support contacts the stop, remove your foot from the loading pedal.
c. Release the switch as you approach the desired angle of bend.
d. Press BEND momentarily until the bend is complete.

1-1/4" to 2" Steel Rigid Conduit:



a. Press and hold BEND.
b. Release the switch as you approach the desired angle of bend.
c. Press BEND momentarily until the bend is complete.

1" EMT, IMC, Steel Rigid and Aluminum Rigid Conduit:



a. Pivot the 1" roller support upward and into position.
b. Press and hold BEND.
c. Release the switch as you approach the desired angle of bend.
d. Press BEND momentarily until the bend is complete.

7. Press UNLOAD. The shoe will rotate backward.

Note: If bending 1-1/4 to 2" EMT, IMC, or Aluminum Rigid Conduit the roller support unit will drop to its original position.

8. Twist the conduit to release it from the hook. Remove the conduit.
9. Press and hold UNLOAD until the shoe has rotated back to 0°.

Operation (cont'd)

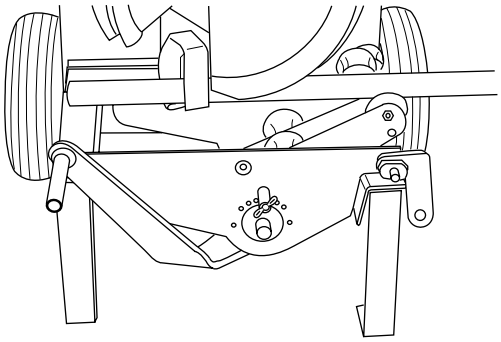
ADJUSTING THE SQUEEZE

When bending 1-1/4" to 2" EMT, IMC and rigid aluminum conduit, the roller support must be engaged so that it contacts the conduit; the pressure against the conduit is the "squeeze." Typically, the squeeze adjustment arm is vertical (at middle hole) but can be changed by moving the position of the thumbscrew.

Due to variations in conduit, the standard adjustment may provide too much or too little squeeze. If the conduit develops excessive side marking when bent, the squeeze is set too high; decrease squeeze one position (hole) clockwise. If the conduit becomes excessively oval or wrinkled, the squeeze is set too low; increase squeeze position (hole) counterclockwise.

When bending 1-1/4" to 2" aluminum rigid conduit, decrease the squeeze by three settings.

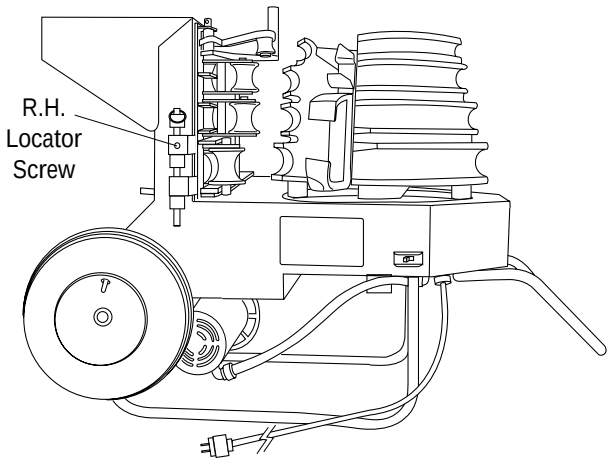
Adjusting the Squeeze



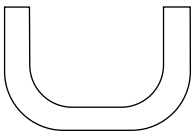
ADJUSTING THE ROLLER SUPPORT ASSEMBLY LOCATION

If the conduit develops excessive side marking when bending in the horizontal position, the location of the roller support assembly might need adjusting. Loosen the left-hand and right-hand locator screws for the Roller Support Assembly (see p. 6) to align the centerline of the roller with the centerline of the shoe groove. Retighten the locator screws.

Adjusting the Roller Support Location

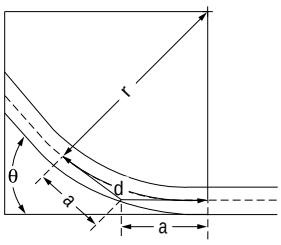


Illustrated Bending Glossary



back-to-back bend — any U-shaped bend formed by two parallel 90° bends with a straight section of conduit or pipe between the bends.

center-to-center distance — the distance between the successive bends that make up an offset or a three-bend saddle.



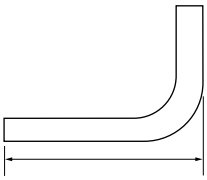
developed length — the actual length of pipe that will be bent; see distance “d” in the illustration at left.

gain — the difference between the straight-line distance (a + a) and the shorter radial distance, (d) where:

θ = angle of bend

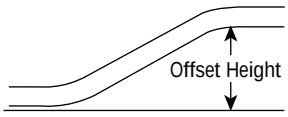
r = the centerline bending radius of the bending shoe

kick — single bend of less than 90°

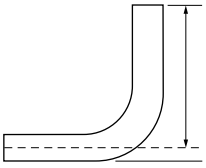


leg length — the distance from the end of a straight section of conduit or pipe to the bend; measured from the end to the outside edge of the conduit or pipe.

offset bend — two opposite bends with the same degree of bend; used to avoid an obstruction.



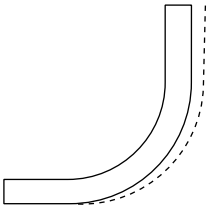
offset height — the distance between the two legs of an offset bend, measured perpendicular to the two legs; also called amount of offset and depth of offset.



rise — the distance from the end of a straight section of conduit or pipe to the bend; measured from the end to the center line of the conduit or pipe. Also called stub or stub-up.

saddle — a three-bend or four-bend combination; used to avoid an obstruction.

shrink — the amount of conduit “lost” when laying out an offset bend working toward an obstruction; see the explanation under Offset Bending in this manual.



springback — the amount, measured in degrees, that a conduit or pipe tends to straighten after being bent.

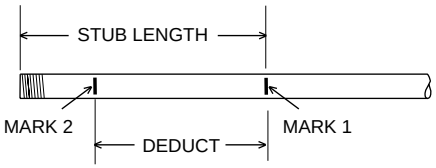
Bending Instructions

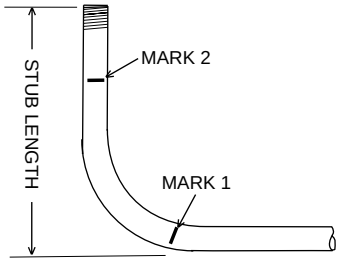
90° STUBS

1. Measure the length of the required stub.
2. See the Minimum Stub Length formula on the Deduct Table. The required stub must be equal to or longer than the Minimum Stub Length.
3. Measure and mark the stub length on the conduit. This is Mark 1. Subtract the Deduct from this mark and make a new mark. This is Mark 2.
4. Align Mark 2 with the front edge of the hook and bend the conduit.

Notes: When the operator presses "UNLOAD", the conduit may spring back a few degrees. Compensate by overbending as shown in the Scale Reading Table.

The shoe bends to 90° maximum.





Deduct Table

SIZE		1	1-1/4	1-1/2	2
DEDUCT	STEEL RIGID	11-7/8	14-3/8	15-3/8	16-5/8
	EMT	11-7/8	14-3/8	15-3/8	16-7/8
	IMC	11-7/8	14-3/8	15-3/8	16-5/8
	ALUM. RIGID	11-7/8	14-3/8	15-3/8	16-5/8
MINIMUM STUB LENGTH = DEDUCT PLUS 2 INCHES					

Figures are approximate

Scale Reading Table

CONDUIT SIZE	STEEL RIGID					EMT				
	15°	30°	45°	60°	90°	15°	30°	45°	60°	90°
1	17-1/2	32-1/2	48-3/4	63-3/4	95	16-1/4	31-1/4	47-1/2	62-1/2	93-3/4
1-1/4	17-1/2	33-3/4	48-3/4	65	95	18-3/4	33-3/4	48-3/4	65	96-1/4
1-1/2	17-1/2	32-1/2	47-1/2	63-3/4	95	17-1/2	32-1/2	48-3/4	63-3/4	95
2	17-1/2	32-1/2	48-3/4	63-3/4	95	17-1/2	32-1/2	47-1/2	63-3/4	93-3/4

CONDUIT SIZE	IMC					ALUMINUM RIGID				
	15°	30°	45°	60°	90°	15°	30°	45°	60°	90°
1	20	35	51-1/4	66-1/4	97-1/2	16-1/4	32-1/2	48-3/4	63-3/4	95
1-1/4	21-1/4	36-1/4	52-1/2	67-1/2	98-3/4	18-3/4	33-3/4	50	65	96-1/4
1-1/2	20	35	51-1/4	66-1/4	97-1/2	17-1/2	33-3/4	48-3/4	65	95
2	21-1/4	36-1/4	52-1/2	67-1/2	98-3/4	18-3/4	35	50	66-1/4	96-1/4

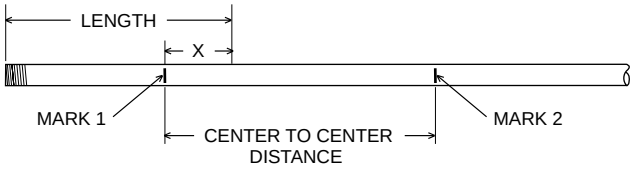
Figures are approximate

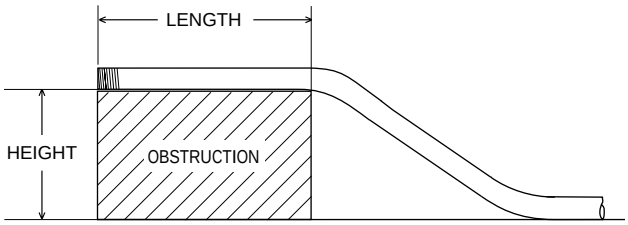
Bending Instructions (cont'd)

Offsets

1. Measure the height and length of the obstruction. Select the angle to be used.
2. See the Offset Table. The height of the obstruction must be equal to or greater than the minimum offset.
3. Refer to the "X" Table to find the "X" dimension. Refer to the Offset Table to find the center-to-center distance.

   Note: If the center-to-center distance is not shown, calculate it by using the multipliers shown in the Offset Table.
4. Mark the conduit as shown.
5. Insert the conduit into the bender. Align Mark 1 with the front edge of the hook and bend the conduit.
6. Align Mark 2 with the front edge of the hook. Without removing the conduit from the bender, rotate the conduit 180°. Make the second bend.





Offset Table

Finished Angle						
	15°		30°		45°	
OFFSET	MAX CONDUIT SIZE	CENTER TO CENTER	MAX CONDUIT SIZE	CENTER TO CENTER	MAX CONDUIT SIZE	CENTER TO CENTER
2	1-1/4	7-3/4				
4	2	15-7/16	1	7-15/16		
6	2	23-3/16	2	11-15/16		
8	2	30-7/8	2	15-15/16	1	11-1/16
10	2	38-5/8	2	19-15/16	2	13-13/16
12	2	46-3/8	2	23-15/16	2	16-5/8
14	2	54-1/16	2	27-15/16	2	19-7/16
16	2	61-13/16	2	31-15/16	2	22-1/4
18	2	69-9/16	2	35-15/16	2	25-1/16
20	2	77-1/4	2	39-15/16	2	27-15/16
22	2	85	2	43-15/16	2	30-3/4

CENTER-TO-CENTER DISTANCE = OFFSET HEIGHT x MULTIPLIER					
OFFSET ANGLE	10°	15°	22-1/2°	30°	45°
MULTIPLIER	5.8	3.9	2.6	2.0	1.4

Figures are approximate

"X" Table

CONDUIT SIZE	1	1-1/4	1-1/2	2
"X"	4-1/16	5-1/16	5-13/16	6-1/8

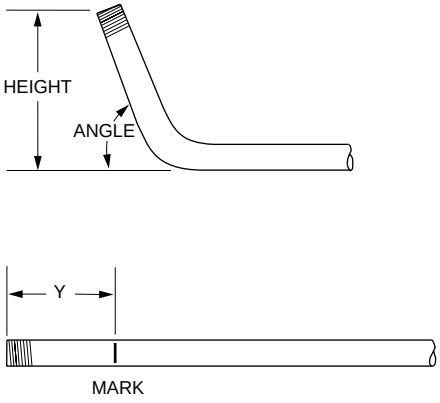
Figures are approximate

Additional Bending Instructions

The following drawings and bending tables are intended to provide the information necessary to accomplish the most common types of bends. The Bending Tables contain conduit marking information.

STUBS

1. Select the size and type of conduit. Determine the height of stub and the angle to be used.
2. Find the table that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the appropriate angle.
4. Find the row labeled Y. In the row at the top of the page, find the height (H) of the stub. The number shown at the intersection of row Y and column H is the distance Y. Place the bending mark Y inches from the end of the conduit.
5. Bend the conduit.



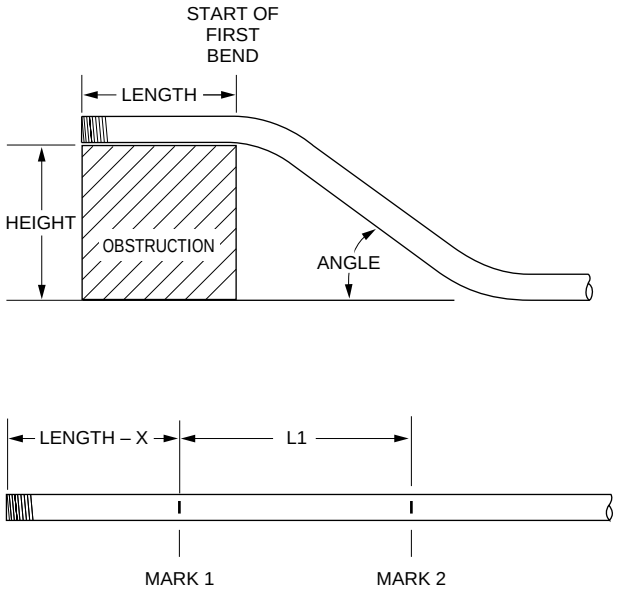
OFFSETS

An offset is used to route the conduit around an obstruction. To make an offset, two equal bends are required. The distance between the two bends is the center-to-center distance.

When working past an obstruction, it is necessary to determine the location of the first bend. The center-to-center distance is then used to determine the location of the second bend. When working toward an obstruction, it is necessary to determine the location of the second bend. The center-to-center distance is then used to determine the location of the first bend.

Working Past an Obstruction

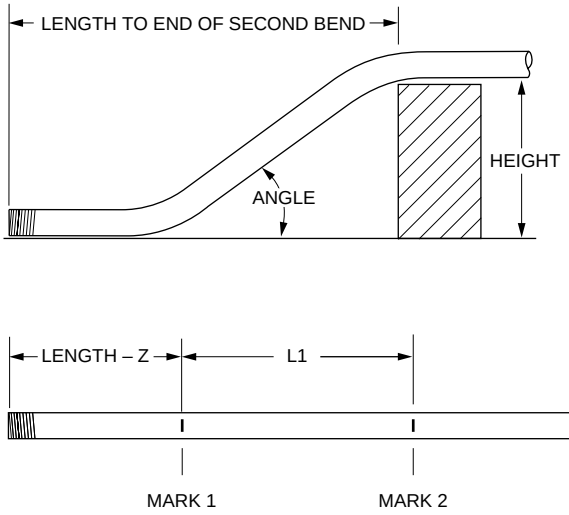
1. Select the size and type of conduit. Measure the height of the obstruction and the distance labeled LENGTH. Determine the angle to be used.
2. Find the table that corresponds to the size and type of conduit selected in Step 1.
3. To the right of the size and type of conduit, find the dimension labeled X. Subtract X from LENGTH. Place the first bending mark this distance from the end of the conduit.
4. Under the column labeled ANGLE, find the appropriate angle. Find the row labeled L1. In the row at the top of the page, find the height (H) of the offset. The number shown at the intersection of row L1 and column H is L1. Place the second bending mark L1 inches from the first bending mark.
5. Bend the conduit.



Additional Bending Instructions (cont'd)

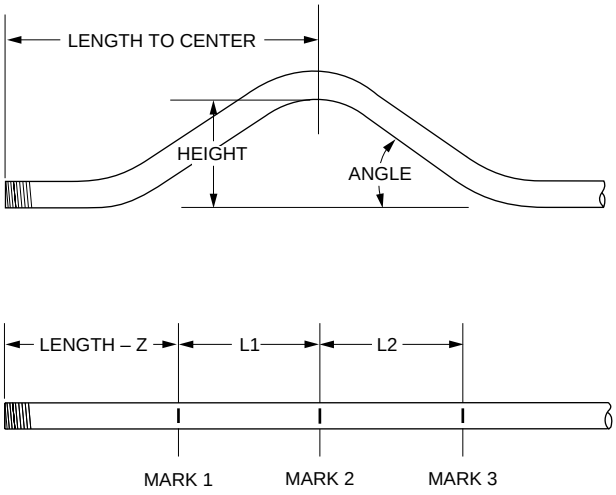
Working Toward an Obstruction

1. Select the size and type of conduit. Measure the height of the obstruction and the distance labeled LENGTH TO END OF SECOND BEND. Determine the angle to be used.
2. Find the table that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the appropriate angle. Find the row labeled Z. In the row at the top of the page, find the height (H) of the offset. The number shown at the intersection of the Z row and the H column is Z. Subtract Z from LENGTH TO THE END OF SECOND BEND. Place the first bending mark this distance from the end of the conduit.
4. In the same column, find the row labeled L1. Place the second bending mark L1 inches from the first bending mark.
5. Bend the conduit.



THREE-BEND SADDLE

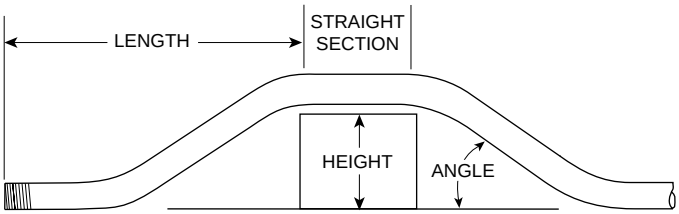
1. Select the size and type of conduit. Measure the height of the obstruction and the distance from the end of the conduit to the center (LENGTH TO CENTER) of the bend. Determine the angle to be used.
2. Find the table that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the appropriate angle. Find the row labeled Z. In the row at the top of the page, find the height (H) of the offset. The number shown at the intersection of the Z row and the appropriate H column is Z. Subtract Z from the LENGTH TO CENTER. Place the first bending mark this distance from the end of the conduit.
4. In the same column, find the row labeled L1. Place the second bending mark L1 inches from the first bending mark.
5. In the same column, find the row labeled L2. Place the third bending mark L2 inches from the second bending mark.
6. Bend the conduit.

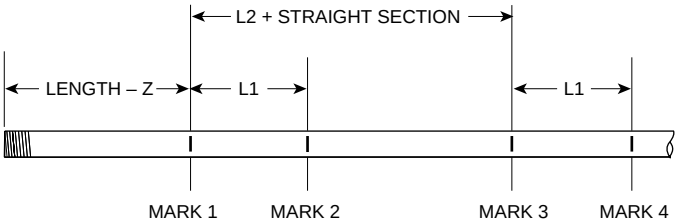


Additional Bending Instructions (cont'd)

FOUR-BEND SADDLE

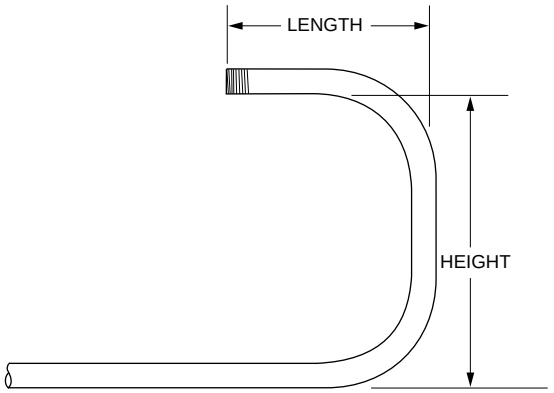
1. Select the size and type of conduit. Measure the height of the obstruction, the distance labeled LENGTH, and the distance labeled STRAIGHT SECTION. Determine the angle to be used.
2. Find the table that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the appropriate angle. Find the row labeled Z. In the row at the top of the page, find the height (H) of the offset. The number shown at the intersection of the Z row and the appropriate H column is Z. Subtract Z from the LENGTH. Place the first bending mark this distance from the end of the conduit.
4. In the same column, find the row labeled L1. Place the second bending mark L1 inches from the first bending mark.
5. In the same column, find the row labeled L2. Add L2 to the STRAIGHT SECTION. Place the third bending mark this distance from the <u>first</u> bending mark.
6. Make the final bending mark L1 inches from the third bending mark.
7. Bend the conduit.

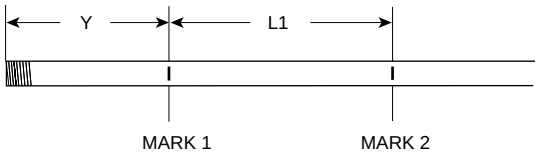




U-BENDS

1. Select the size and type of conduit. Determine the LENGTH and the HEIGHT.
2. Find the table that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find 90°.
4. Find the row labeled Y. In the row at the top of the page, find the height (H) that corresponds to the LENGTH. The number shown at the intersection of the Y row and the appropriate H column is the distance Y. Place the bending mark Y inches from the end of the conduit.
5. Find the row labeled L1, and go to the right to find the height (H) that corresponds to the HEIGHT.
6. The number shown at the intersection of the L1 row and the appropriate H column is L1. Place the second bending mark L1 inches from the first mark.
7. Bend the conduit.





Bending Tables

	DIM	ANGLE	2"	4"	6"	8"	10"	12"	15"	18"	24"	36"
1" EMT												
	Y	15	0.49	8.22	15.94	23.67	31.40	39.13	50.72	62.31	85.49	131.85
	L1	15	7.72	15.44	23.17	30.90	38.63	46.35	57.94	69.54	92.72	139.08
	L2	15	9.61	17.34	25.06	32.79	40.52	48.25	59.84	71.43	94.61	140.98
	Z	15	13.41	20.87	28.34	35.80	43.27	50.73	61.93	73.12	95.51	140.30
MINIMUM H = 1.54												
	Y	22.5		3.45	8.68	13.91	19.13	24.36	32.20	40.04	55.72	87.07
	L1	22.5	5.19	10.42	15.64	20.87	26.09	31.32	39.16	47.00	62.68	94.04
	L2	22.5	8.03	13.26	18.48	23.71	28.93	34.16	42.00	49.84	65.52	96.88
	Z	22.5	11.75	16.57	21.40	26.23	31.06	35.89	43.13	50.37	64.86	93.83
MINIMUM H = 2.65												
	Y	30		0.86	4.86	8.86	12.86	16.86	22.86	28.86	40.86	64.86
	L1	30	3.91	7.91	11.91	15.91	19.91	23.91	29.91	35.91	47.91	71.91
	L2	30	7.70	11.70	15.70	19.70	23.70	27.70	33.70	39.70	51.70	75.70
	Z	30	11.38	14.84	18.31	21.77	25.24	28.70	33.90	39.09	49.49	70.27
MINIMUM H = 3.96												
	Y	45			0.63	3.46	6.28	9.11	13.35	17.60	26.08	43.05
	L1	45			8.17	11.00	13.83	16.66	20.90	25.14	33.63	50.60
	L2	45			13.85	16.68	19.51	22.34	26.58	30.83	39.31	56.28
	Z	45			16.03	18.03	20.03	22.03	25.03	28.03	34.03	46.03
MINIMUM H = 7.09												
	Y	60				0.35	2.66	4.97	8.43	11.90	18.83	32.68
	L1	60					10.77	13.08	16.54	20.01	26.94	40.79
	L2	60					18.34	20.65	24.12	27.58	34.51	48.37
	Z	60					18.17	19.32	21.05	22.78	26.25	33.18
MINIMUM H = 10.73												
	Y	90						0.15	3.15	6.15	12.15	24.15
	L1	90								14.90	20.90	32.90
	L2	90								26.26	32.26	44.26
	Z	90								18.51	18.51	18.51
MINIMUM H = 18.51												
1-1/4" EMT												
	Y	15		6.43	14.15	21.88	29.61	37.34	48.93	60.52	83.70	130.06
	L1	15	7.71	15.44	23.17	30.90	38.62	46.35	57.94	69.53	92.72	139.08
	L2	15	9.95	17.67	25.40	33.13	40.86	48.58	60.17	71.77	94.95	141.31
	Z	15	14.70	22.16	29.63	37.09	44.56	52.02	63.22	74.41	96.80	141.59
MINIMUM H = 1.87												
	Y	22.5		1.79	7.02	12.25	17.47	22.70	30.54	38.38	54.06	85.41
	L1	22.5	5.18	10.41	15.64	20.86	26.09	31.31	39.15	46.99	62.67	94.03
	L2	22.5	8.53	13.76	18.98	24.21	29.44	34.66	42.50	50.34	66.02	97.38
	Z	22.5	13.21	18.04	22.87	27.70	32.52	37.35	44.59	51.84	66.32	95.29
MINIMUM H = 3.21												
	Y	30			3.22	7.22	11.22	15.22	21.22	27.22	39.22	63.22
	L1	30		7.90	11.90	15.90	19.90	23.90	29.90	35.90	47.90	71.90
	L2	30		12.36	16.36	20.36	24.36	28.36	34.36	40.36	52.36	76.36
	Z	30		16.49	19.95	23.41	26.88	30.34	35.54	40.74	51.13	71.91
MINIMUM H = 4.78												
	Y	45				1.72	4.55	7.38	11.62	15.87	24.35	41.32
	L1	45				10.95	13.78	16.60	20.85	25.09	33.57	50.54
	L2	45				17.64	20.47	23.30	27.54	31.78	40.27	57.24
	Z	45				20.05	22.05	24.05	27.05	30.05	36.05	48.05
MINIMUM H = 8.52												
	Y	60					0.76	3.07	6.54	10.00	16.93	30.79
	L1	60						12.94	16.40	19.87	26.80	40.65
	L2	60						21.87	25.33	28.80	35.72	49.58
	Z	60						21.76	23.49	25.23	28.69	35.62
MINIMUM H = 12.85												
	Y	90							0.73	3.73	9.73	21.73
	L1	90								14.34	20.34	32.34
	L2	90								27.73	33.73	45.73
	Z	90								22.04	22.04	22.04
MINIMUM H = 22.04												

Bending Tables (cont'd)

	DIM	ANGLE	2"	4"	6"	8"	10"	12"	15"	18"	24"	36"
1-1/2" EMT												
	Y	15		5.20	12.93	20.65	28.38	36.11	47.70	59.29	82.47	128.84
	L1	15	7.71	15.44	23.17	30.90	38.62	46.35	57.94	69.53	92.72	139.08
	L2	15	9.97	17.70	25.43	33.15	40.88	48.61	60.20	71.79	94.97	141.34
	Z	15	15.49	22.96	30.42	37.89	45.35	52.81	64.01	75.21	97.60	142.38
MINIMUM H = 2.08												
	Y	22.5		0.70	5.93	11.16	16.38	21.61	29.45	37.29	52.97	84.32
	L1	22.5	5.18	10.41	15.63	20.86	26.09	31.31	39.15	46.99	62.67	94.03
	L2	22.5	8.57	13.79	19.02	24.25	29.47	34.70	42.54	50.38	66.06	97.41
	Z	22.5	14.02	18.85	23.67	28.50	33.33	38.16	45.40	52.64	67.13	96.10
MINIMUM H = 3.52												
	Y	30			2.19	6.19	10.19	14.19	20.19	26.19	38.19	62.19
	L1	30		7.89	11.89	15.89	19.89	23.89	29.89	35.89	47.89	71.89
	L2	30		12.41	16.41	20.41	24.41	28.41	34.41	40.41	52.41	76.41
	Z	30		17.31	20.77	24.23	27.70	31.16	36.36	41.56	51.95	72.73
MINIMUM H = 5.19												
	Y	45				0.75	3.58	6.41	10.65	14.90	23.38	40.35
	L1	45				10.94	13.77	16.60	20.84	25.09	33.57	50.54
	L2	45				17.71	20.54	23.37	27.61	31.85	40.34	57.31
	Z	45				20.90	22.90	24.90	27.90	30.90	36.90	48.90
MINIMUM H = 9.12												
	Y	60						2.12	5.58	9.04	15.97	29.83
	L1	60						12.93	16.39	19.86	26.79	40.64
	L2	60						21.95	25.42	28.88	35.81	49.67
	Z	60						22.64	24.37	26.10	29.57	36.50
MINIMUM H = 13.61												
	Y	90								2.75	8.75	20.75
	L1	90								14.30	20.30	32.30
	L2	90								27.84	33.84	45.84
	Z	90								23.00	23.00	23.00
MINIMUM H = 23.00												
2" EMT												
	Y	15		3.79	11.51	19.24	26.97	34.70	46.29	57.88	81.06	127.42
	L1	15	7.71	15.44	23.17	30.90	38.62	46.35	57.94	69.53	92.71	139.08
	L2	15	10.22	17.94	25.67	33.40	41.12	48.85	60.44	72.03	95.22	141.58
	Z	15	16.14	23.60	31.07	38.53	46.00	53.46	64.66	75.85	98.25	143.03
MINIMUM H = 2.25												
	Y	22.5			4.74	9.97	15.20	20.42	28.26	36.10	51.78	83.14
	L1	22.5	5.18	10.40	15.63	20.86	26.08	31.31	39.15	46.99	62.67	94.02
	L2	22.5	8.93	14.16	19.38	24.61	29.84	35.06	42.90	50.74	66.42	97.78
	Z	22.5	14.79	19.62	24.45	29.28	34.10	38.93	46.18	53.42	67.90	96.87
MINIMUM H = 3.81												
	Y	30			1.08	5.08	9.08	13.08	19.08	25.08	37.08	61.08
	L1	30		7.88	11.88	15.88	19.88	23.88	29.88	35.88	47.88	71.88
	L2	30		12.89	16.89	20.89	24.89	28.89	34.89	40.89	52.89	76.89
	Z	30		18.21	21.67	25.14	28.60	32.07	37.26	42.46	52.85	73.64
MINIMUM H = 5.64												
	Y	45					2.47	5.30	9.54	13.78	22.27	39.24
	L1	45				10.90	13.73	16.56	20.80	25.04	33.53	50.50
	L2	45				18.41	21.24	24.07	28.31	32.55	41.04	58.01
	Z	45				22.08	24.08	26.08	29.08	32.08	38.08	50.08
MINIMUM H = 9.95												
	Y	60						0.91	4.37	7.84	14.76	28.62
	L1	60						12.83	16.29	19.76	26.69	40.54
	L2	60						22.84	26.30	29.77	36.69	50.55
	Z	60						24.12	25.86	27.59	31.05	37.98
MINIMUM H = 14.89												
	Y	90								1.18	7.18	19.18
	L1	90									19.90	31.90
	L2	90									34.91	46.91
	Z	90									25.28	25.28
MINIMUM H= 25.28												

Bending Tables (cont'd)

	DIM	ANGLE	2"	4"	6"	8"	10"	12"	15"	18"	24"	36"
1" IMC, Steel Rigid and Aluminum Rigid												
	Y	15	0.19	7.91	15.64	23.37	31.09	38.82	50.41	62.00	85.19	131.55
	L1	15	7.72	15.44	23.17	30.90	38.63	46.35	57.94	69.54	92.72	139.08
	L2	15	9.59	17.32	25.04	32.77	40.50	48.23	59.82	71.41	94.59	140.96
	Z	15	13.41	20.87	28.34	35.80	43.26	50.73	61.92	73.12	95.51	140.30
MINIMUM H = 1.54												
	Y	22.5		3.25	8.48	13.70	18.93	24.16	32.00	39.84	55.51	86.87
	L1	22.5	5.19	10.42	15.64	20.87	26.09	31.32	39.16	47.00	62.68	94.04
	L2	22.5	8.00	13.23	18.45	23.68	28.90	34.13	41.97	49.81	65.49	96.85
	Z	22.5	11.73	16.56	21.39	26.22	31.05	35.88	43.12	50.36	64.85	93.82
MINIMUM H = 2.64												
	Y	30		0.71	4.71	8.71	12.71	16.71	22.71	28.71	40.71	64.71
	L1	30	3.91	7.91	11.91	15.91	19.91	23.91	29.91	35.91	47.91	71.91
	L2	30	7.66	11.66	15.66	19.66	23.66	27.66	33.66	39.66	51.66	75.66
	Z	30	11.36	14.82	18.29	21.75	25.21	28.68	33.87	39.07	49.46	70.25
MINIMUM H = 3.95												
	Y	45			0.53	3.36	6.19	9.02	13.26	17.50	25.99	42.96
	L1	45			8.18	11.01	13.83	16.66	20.91	25.15	33.63	50.60
	L2	45			13.80	16.63	19.45	22.28	26.52	30.77	39.25	56.22
	Z	45			15.99	17.99	19.99	21.99	24.99	27.99	33.99	45.99
MINIMUM H = 7.06												
	Y	60				0.29	2.60	4.91	8.37	11.83	18.76	32.62
	L1	60					10.78	13.09	16.55	20.02	26.94	40.80
	L2	60					18.27	20.58	24.04	27.51	34.44	48.29
	Z	60					18.09	19.25	20.98	22.71	26.18	33.11
MINIMUM H = 10.67												
	Y	90						0.13	3.13	6.13	12.13	24.13
	L1	90								14.93	20.93	32.93
	L2	90								26.17	32.17	44.17
	Z	90								18.37	18.37	18.37
MINIMUM H = 18.37												
1-1/4" IMC, Steel Rigid and Aluminum Rigid												
	Y	15		6.00	13.72	21.45	29.18	36.90	48.50	60.09	83.27	129.63
	L1	15	7.71	15.44	23.17	30.90	38.62	46.35	57.94	69.53	92.72	139.08
	L2	15	9.93	17.65	25.38	33.11	40.84	48.56	60.16	71.75	94.93	141.29
	Z	15	14.83	22.29	29.76	37.22	44.69	52.15	63.35	74.54	96.93	141.72
MINIMUM H = 1.91												
	Y	22.5		1.46	6.69	11.91	17.14	22.37	30.21	38.05	53.72	85.08
	L1	22.5	5.18	10.41	15.64	20.86	26.09	31.31	39.15	46.99	62.67	94.03
	L2	22.5	8.50	13.73	18.95	24.18	29.41	34.63	42.47	50.31	65.99	97.35
	Z	22.5	13.33	18.16	22.99	27.82	32.64	37.47	44.72	51.96	66.44	95.41
MINIMUM H = 3.25												
	Y	30			2.94	6.94	10.94	14.94	20.94	26.94	38.94	62.94
	L1	30		7.90	11.90	15.90	19.90	23.90	29.90	35.90	47.90	71.90
	L2	30		12.32	16.32	20.32	24.32	28.32	34.32	40.32	52.32	76.32
	Z	30		16.60	20.06	23.53	26.99	30.45	35.65	40.85	51.24	72.02
MINIMUM H = 4.83												
	Y	45				1.50	4.33	7.16	11.40	15.64	24.13	41.10
	L1	45				10.95	13.78	16.61	20.85	25.09	33.58	50.55
	L2	45				17.59	20.42	23.25	27.49	31.73	40.22	57.19
	Z	45				20.14	22.14	24.14	27.14	30.14	36.14	48.14
MINIMUM H = 8.59												
	Y	60					0.57	2.88	6.34	9.81	16.73	30.59
	L1	60						12.95	16.41	19.88	26.80	40.66
	L2	60						21.80	25.26	28.73	35.66	49.51
	Z	60						21.83	23.56	25.29	28.76	35.68
MINIMUM H = 12.90												
	Y	90							0.58	3.58	9.58	21.58
	L1	90								14.37	20.37	32.37
	L2	90								27.65	33.65	45.65
	Z	90								22.04	22.04	22.04
MINIMUM H = 22.04												

Bending Tables (cont'd)

DIM	ANGLE	2"	4"	6"	8"	10"	12"	15"	18"	24"	36"
1-1/2" IMC, Steel Rigid and Aluminum Rigid											
Y	15		4.75	12.48	20.21	27.93	35.66	47.25	58.84	82.03	128.39
L1	15	7.71	15.44	23.17	30.90	38.62	46.35	57.94	69.53	92.72	139.08
L2	15	9.95	17.68	25.40	33.13	40.86	48.58	60.18	71.77	94.95	141.31
Z	15	15.62	23.08	30.55	38.01	45.48	52.94	64.14	75.33	97.73	142.51
MINIMUM H = 2.11											
Y	22.5		0.36	5.59	10.82	16.04	21.27	29.11	36.95	52.63	83.98
L1	22.5	5.18	10.41	15.64	20.86	26.09	31.31	39.15	46.99	62.67	94.03
L2	22.5	8.53	13.76	18.98	24.21	29.44	34.66	42.50	50.34	66.02	97.38
Z	22.5	14.13	18.96	23.79	28.62	33.45	38.27	45.52	52.76	67.24	96.22
MINIMUM H = 3.56											
Y	30			1.90	5.90	9.90	13.90	19.90	25.90	37.90	61.90
L1	30		7.90	11.90	15.90	19.90	23.90	29.90	35.90	47.90	71.90
L2	30		12.36	16.36	20.36	24.36	28.36	34.36	40.36	52.36	76.36
Z	30		17.41	20.87	24.34	27.80	31.27	36.46	41.66	52.05	72.83
MINIMUM H = 5.24											
Y	45				0.53	3.36	6.18	10.43	14.67	23.15	40.12
L1	45				10.95	13.78	16.60	20.85	25.09	33.57	50.54
L2	45				17.65	20.47	23.30	27.55	31.79	40.27	57.24
Z	45				20.98	22.98	24.98	27.98	30.98	36.98	48.98
MINIMUM H = 9.18											
Y	60						1.92	5.39	8.85	15.78	29.64
L1	60						12.94	16.40	19.87	26.80	40.65
L2	60						21.87	25.34	28.80	35.73	49.58
Z	60						22.69	24.42	26.15	29.62	36.54
MINIMUM H = 13.65											
Y	90								2.61	8.61	20.61
L1	90								14.34	20.34	32.34
L2	90								27.74	33.74	45.74
Z	90								22.97	22.97	22.97
MINIMUM H = 22.97											
2" IMC, Steel Rigid and Aluminum Rigid											
Y	15		3.46	11.18	18.91	26.64	34.36	45.96	57.55	80.73	127.09
L1	15	7.71	15.44	23.17	30.90	38.62	46.35	57.94	69.53	92.71	139.08
L2	15	10.14	17.87	25.60	33.32	41.05	48.78	60.37	71.96	95.14	141.51
Z	15	16.10	23.56	31.03	38.49	45.95	53.42	64.61	75.81	98.20	142.99
MINIMUM H = 2.23											
Y	22.5			4.54	9.77	14.99	20.22	28.06	35.90	51.58	82.93
L1	22.5	5.18	10.40	15.63	20.86	26.08	31.31	39.15	46.99	62.67	94.02
L2	22.5	8.82	14.05	19.28	24.50	29.73	34.95	42.79	50.63	66.31	97.67
Z	22.5	14.71	19.54	24.37	29.20	34.02	38.85	46.09	53.34	67.82	96.79
MINIMUM H = 3.78											
Y	30			0.95	4.95	8.95	12.95	18.95	24.95	36.95	60.95
L1	30		7.89	11.89	15.89	19.89	23.89	29.89	35.89	47.89	71.89
L2	30		12.74	16.74	20.74	24.74	28.74	34.74	40.74	52.74	76.74
Z	30		18.09	21.55	25.02	28.48	31.95	37.14	42.34	52.73	73.52
MINIMUM H = 5.58											
Y	45					2.43	5.26	9.50	13.74	22.23	39.20
L1	45				10.91	13.74	16.57	20.81	25.06	33.54	50.51
L2	45				18.20	21.03	23.86	28.10	32.34	40.83	57.80
Z	45				21.88	23.88	25.88	28.88	31.88	37.88	49.88
MINIMUM H = 9.81											
Y	60						0.94	4.40	7.87	14.79	28.65
L1	60						12.86	16.32	19.79	26.72	40.57
L2	60						22.58	26.04	29.50	36.43	50.29
Z	60						23.83	25.56	27.30	30.76	37.69
MINIMUM H = 14.64											
Y	90								1.34	7.34	19.34
L1	90									20.02	32.02
L2	90									34.59	46.59
Z	90									24.75	24.75
MINIMUM H = 24.27											

Handle Removal and Replacement

The handle of the 853 is removable. This feature is convenient when performing complex bending, and makes it easy to replace a damaged handle.

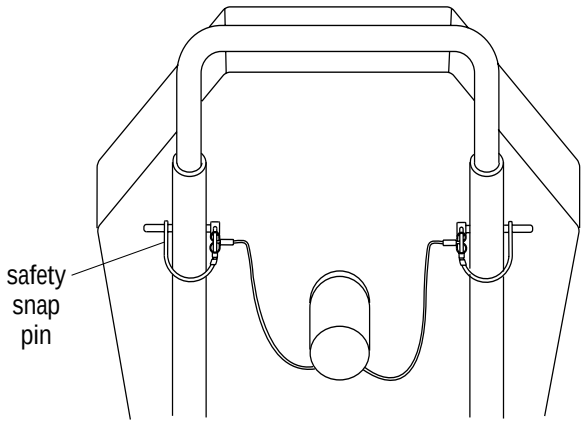
Removal

1. Place the bender in the upright position.
2. Release the spring clip on the safety snap pin.
3. Remove the pin from the handle and the sleeve of the frame.
4. Repeat for the other end of the handle.
5. Lift the handle to remove.

Replacement

1. Insert the handle into the sleeves of the frame.
2. Align the holes in the handle with the holes in the sleeves.
3. Insert the safety snap pin. Ensure that the pin goes through the handle and the sleeve on the frame.
4. Engage the safety spring clip over the end of the pin. Ensure that the loop on the clip is completely around the pin.
5. Repeat for the other end of the handle.

Removing or Replacing Handle



⚠WARNING

Make sure that the handle is properly installed and secured with the safety spring clips and snap pins before lifting or moving the bender. An improperly installed handle could allow the bender to fall, injuring nearby personnel.

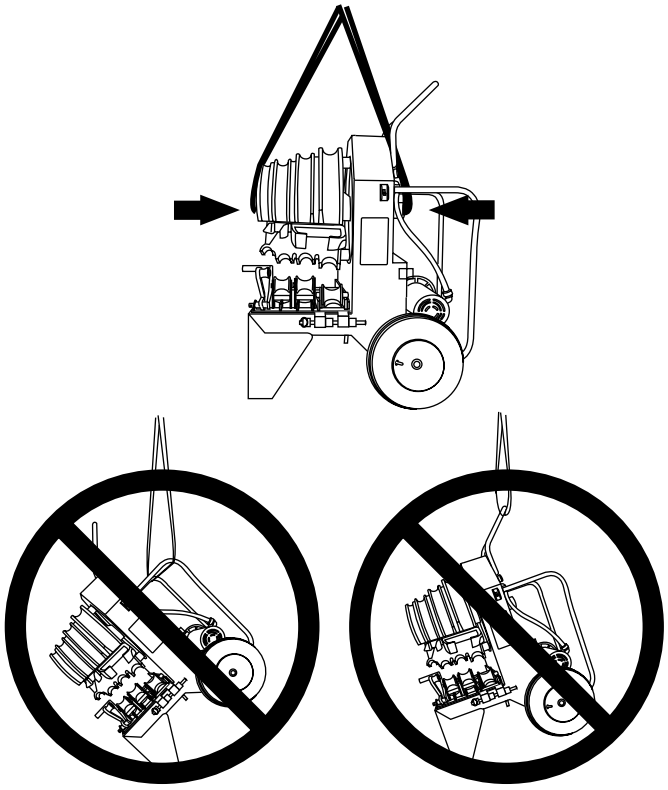
Failure to observe this warning can result in severe injury or death.

Transporting the Bender

Make sure that all components used to lift this bender are properly rated for the 202 kg (445 lb) weight. Use a ramp to load and unload the bender from a truck or other vehicle that is not equipped with a lift gate.

To lift the bender, loop a nylon or polyester sling through the spindle. Thread one end of the sling through the length of the spindle as shown. Securely fasten to lifting device.

Lifting Bender



⚠WARNING

Lift bender using a nylon or polyester sling through the spindle. Do not attempt to lift bender by the handles. Make sure all lifting components are properly rated for the 202 (445 lb) weight.

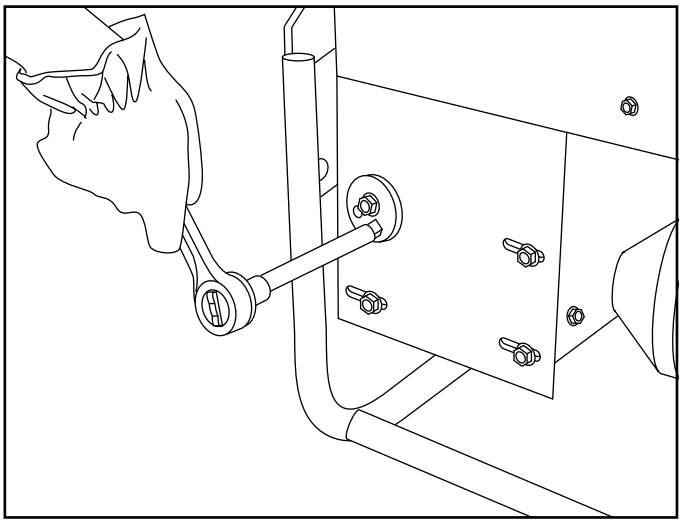
Failure to observe this warning can result in severe injury or death.

Maintenance

There is no need for periodic flushing and replacing of lube in the bender gear box since it is sealed and locked tight. However, if the box is opened for repair and the lube is lost or contaminated by dirt, then the box and parts should be flushed out and filled with 26 fluid ounces of Mobil® 634 synthetic oil.

Flushing should be accomplished with kerosene, which is a petroleum hydrocarbon that does not affect seals.

Note: Aromatic hydrocarbons such as benzine, chlorinated solvents such as carbon-tetrachloride, and ketones such as acetone should never be used for flushing as they are solvents for rubber. They are also harmful to the environment.



⚠WARNING

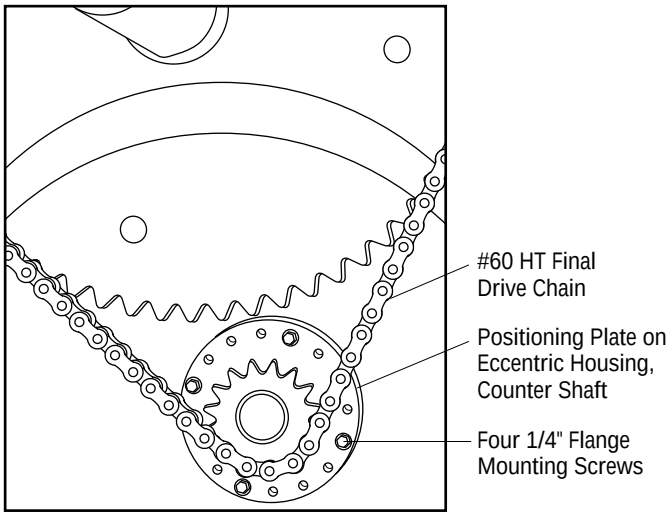
Disconnect this tool when not in use, before servicing or adjusting, and when changing shoes or conduit rollers and supports.

Failure to observe this warning can result in severe injury or death.

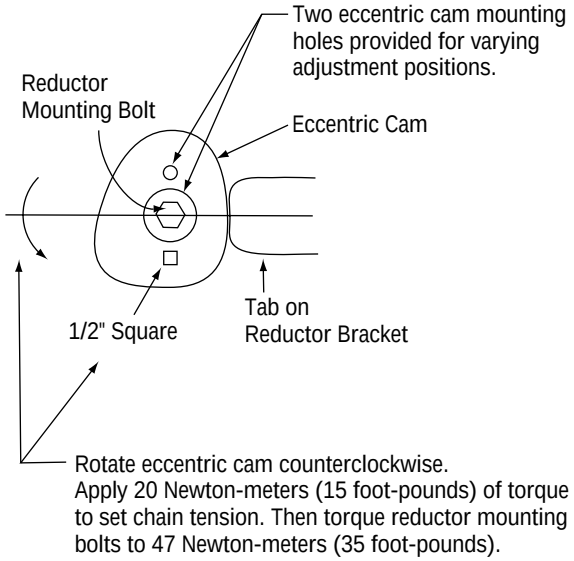
Chain Adjustment

Both chains have to be adjusted if the final drive #60 chain is to be reset.

1. Remove the front cover and upper rear guard.
2. Loosen the eight mounting bolts for the reductor. Remove the eccentric cam and move the reductor to create chain slack.
3. Remove the four retaining screws for eccentric adjustment. Rotate to remove slack from the chain and align with one of the two sets of holes in the frame. Remount the eccentric with the four bolts.
4. Slide the reductor in slotted mounting holes to the retension chain. Set tension with the eccentric cam.



With the eight reductor mounting bolts loose, rotate the eccentric cam with a 1/2" square drive to tension the chain. Torque the eight reductor mounting bolts to 47 Newton-meters (35 foot-pounds).


Two eccentric cam mounting holes provided for varying adjustment positions.
Reductor Mounting Bolt
Eccentric Cam
1/2" Square
Tab on Reductor Bracket
Rotate eccentric cam counterclockwise.
Apply 20 Newton-meters (15 foot-pounds) of torque to set chain tension. Then torque reductor mounting bolts to 47 Newton-meters (35 foot-pounds).

Troubleshooting

PROBLEM	PROBABLE CAUSE	POSSIBLE REMEDY
Bender will not operate.	No voltage.	Check supply voltage circuit operation. Check that switch is on.
Bends are overbent a few degrees.	Pointer is adjusted wrong.	Loosen pointer locking screws and rotate clockwise to compensate. Retighten locking screws.
	Too much squeeze on 1-1/4", 1-1/2" or 2" EMT, IMC or Rigid Aluminum conduit.	Back squeeze off per adjustment instructions.
	Unusual conduit characteristics.	Bend smaller angle to compensate.
Bends are underbent a few degrees.	Pointer is adjusted wrong.	Loosen pointer locking screws and rotate counterclockwise to compensate. Retighten locking screws.
	Too little squeeze on 1-1/4", 1-1/2" or 2" EMT, IMC or Rigid Aluminum conduit.	Increase squeeze per adjustment instructions.
	Unusual conduit characteristics.	Bend larger angle to compensate.

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